

ABSTRACT OF THE DISCLOSURE

A deposition method includes, at a first temperature, contacting a substrate with a surface activation agent and adsorbing a first layer over the substrate. At a second temperature greater than the first temperature, the first layer may be contacted with a first precursor, chemisorbing a second layer at least one monolayer thick over the substrate. The first layer may enhance a chemisorption rate of the first precursor compared to the substrate without the surface activation agent adsorbed thereon. One deposition apparatus includes a deposition chamber with a precursor gas dispenser in a contacting zone and a cooling gas dispenser in a cooling zone. A substrate chuck moves by linear translational motion from the contacting zone to the cooling zone. The substrate chuck includes a substrate lift that positions a deposition substrate at an elevation above a heated surface of the substrate chuck when dispensing a cooling gas or surface activation agent. Another deposition apparatus includes a cooling chamber with a cooled substrate chuck and a contacting chamber with a heated substrate chuck. The contacting chamber also has a precursor gas dispenser and the heated substrate chuck includes a substrate lift. A robotic substrate handler moves a substrate from the cooled substrate chuck to the heated substrate chuck.